

## Crash Course in Chemistry

### Chemical Bonds (aka Intramolecular Forces)

- atoms form chemical bonds in order to have the same number of electrons as the closest Noble Gas (i.e. to become stable)
- there are 2 types of chemical bonds: ionic and covalent

#### Ionic bonds:

- form between a metal and non-metal (eg NaCl, CaF<sub>2</sub>)
- a transfer of electrons from the metal to the non-metal occurs
- the metal becomes a positively charged ion (cation)
- the non-metal becomes a negatively charged ion (anion)

#### Covalent bonds:

- form between 2 non-metals
- the electrons forming the bond are shared by the 2 atoms (because neither atom is strong enough to remove the electron from the other atom)
- a **pure covalent** bond is an equal sharing of the electron pair and is formed when the electronegativity values of the 2 atoms in the bond are identical (i.e. 2 C's)
- a **polar covalent** bond is an unequal sharing of the electron pair and is formed when there is an electronegativity difference between the 2 atoms (i.e. C and O)
- in a polar covalent bond the more electronegative atom has a slight negative charge and is labelled  $\delta^-$  while the less electronegative atom has a slight positive charge and is labelled  $\delta^+$  (i.e. dipoles are present)

### Polar Molecules

- when a molecule contains polar bonds, the entire molecule may be polar
- polar molecules have an uneven distribution of charges resulting in a positive charge at one end and a negative charge at the other end (must have polar bonds and asymmetry in its shape)
- non-polar molecules have an equal distribution of charges, resulting in no localized charges (the bonds may still be polar)

### Intermolecular Forces

- forces of attraction between two molecules
- much weaker than the Intramolecular forces and are much easier to break.
- physical changes (changes of state) break or weaken these forces.
- these forces determine the physical properties of a substance.
- 3 types

#### London Dispersion

- these forces are based on the simultaneous attraction of the electrons of one molecule by the positive nuclei of neighbouring molecules
- exist in all molecules
- the strength of the force is directly related to the number of electrons and protons in a given molecule
- the greater the number of electrons and protons the greater the force

#### Dipole-Dipole Forces

- occur between polar molecules having dipoles
- these forces are based on the simultaneous attraction of the negative dipole of one molecule to the positive dipole of the other molecule

#### Hydrogen Bonds

- a special type of dipole-dipole forces
- occur between Hydrogen atoms in one molecule and highly electronegative atoms (F, O, N) in another.
- the strongest of the intermolecular forces and are about 1/10 the strength of a covalent bond.
- for a substance to dissolve in water it must be able to hydrogen bond.